Agency for Healthcare Research and Quality
Advancing Excellence in Health Care

NATIONAL QUALITY MEASURES CLEARINGHOUSE

General

Title

Heart failure (HF): hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following HF hospitalization.

Source(s)

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 condition-specific measures updates and specifications report: hospital-level 30-day risk-standardized mortality measures. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017 Mar. 98 p. [29 references]

Measure Domain

Primary Measure Domain

Clinical Quality Measures: Outcome

Secondary Measure Domain

Does not apply to this measure

Brief Abstract

Description

This measure estimates a hospital-level, 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of heart failure (HF). Mortality is defined as death from any cause within 30 days of the start of the index admission.

The Centers for Medicare & Medicaid Services (CMS) annually reports the measure for individuals who are 65 years and older and are Medicare Fee-for-Service (FFS) beneficiaries hospitalized in non-federal short-term acute care hospitals (including Indian Health Services hospitals) and critical access hospitals.

Rationale

Heart failure (HF) is the leading cause of hospitalization among Medicare beneficiaries and is associated with considerable risk of morbidity and mortality. Although heart failure is a progressive illness for which

death may be an inevitable consequence rather than a marker of poor quality, clinical experience suggests that the care for these patients is highly variable and studies suggest quality gaps in hospital care, particular in the transition to outpatient care. Moreover, there is substantial interhospital variation in the risk of death at 30 days that is not explained by differences in case mix. Many stakeholders, including patient organizations, are interested in outcomes measures for this common condition that could be used to assess the relative performance of a hospital and provide the opportunity for comparison with other institutions.

Since the most commonly available data across hospitals in the United States are administrative billing data, a measure is most widely applicable if it makes use of these data. Since there are concerns about the adequacy of administrative data, the measures using these data should be, if possible, validated against measures based on higher quality data (e.g., chart data). The Centers for Medicare & Medicaid Services (CMS) also believes that an outcomes measure for public reporting should have the following properties: the method by which the measure is calculated and information about its performance are publicly available, the patient sample accurately reflects patients treated for the condition at each hospital (e.g., transfers out are included, multiple readmissions are excluded, patients likely not to have HF despite their International Classification of Diseases, Tenth Revision, Clinical Modification [ICD-10-CM] are excluded), the measure is adjusted for conditions present on admission, not those that develop during the hospitalization, the measure is based on a standard period of outcome assessment, the measure is adjusted for past health care utilization history, risk factors are clinically coherent (not just data driven), statistical methods take into account the structure of the data (e.g., patients within hospitals), and results are reported in a way that reflects the degree of certainty about a hospital's performance. In CMS's assessment, no popular outcomes measure for HF satisfies all of these criteria. Accordingly, CMS has sought to develop a measure with these properties.

Evidence for Rationale

Yale University, under CMS contract through the Colorado Foundation for Medical Care, Mathematica Policy Research. HF 30-day mortality. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2005 Jan 20. 7 p.

Primary Health Components

Heart failure (HF); 30-day mortality rate

Denominator Description

The measure cohort consists of admissions for Medicare Fee-for-Service (FFS) beneficiaries aged 65 years or older and discharged from non-federal acute care hospitals and critical access hospitals, having a principal discharge diagnosis of heart failure (HF).

The risk-standardized mortality rate (RSMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the denominator is the number of deaths expected based on the nation's performance with that hospital's case mix.

See the related "Denominator Inclusions/Exclusions" field.

Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, this field is used to define the measure cohort.

See the *2017 Condition-specific Measures Updates and Specifications Report. Hospital-level 30-day Risk-standardized Mortality Measures* for more details.

Numerator Description

The measure counts death from any cause within 30 days of the start of the index admission.

The risk-standardized mortality rate (RSMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted based on the hospital's performance with its observed case mix.

Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, this field is used to define the outcome.

See the *2017 Condition-specific Measures Updates and Specifications Report. Hospital-level 30-day Risk-standardized Mortality Measures* for more details.

Evidence Supporting the Measure

Type of Evidence Supporting the Criterion of Quality for the Measure

One or more research studies published in a National Library of Medicine (NLM) indexed, peer-reviewed journal

Additional Information Supporting Need for the Measure

- Heart failure (HF) incidence approaches 10 per 1000 population after 65 years of age (National Heart, Lung, and Blood Institute, n.d.), and is the most common discharge diagnosis among the elderly (Jessup & Brozena, 2003); prevalence of HF in the United States (U.S.) is estimated at nearly 6 million. (Lloyd-Jones et al., 2010), and is suspected to be the leading cause of death in people over age 65.
- Many current hospital interventions are known to decrease the risk of death within 30 days of hospital admission (Jha et al., 2007). Current process-based performance measures, however, cannot capture all the ways that care within the hospital might influence outcomes. As a result, many stakeholders, including patient organizations, are interested in outcomes measures that allow patients and providers to assess relative hospital performance on outcomes measures.
- Numerous studies have demonstrated that appropriate and timely treatment for HF patients can reduce the risk of mortality within 30 days of hospital admission. (Hunt et al., 2009; Jha et al., 2007) Additionally, trials of interventions which improve patient education upon discharge have been shown to improve survival for HF patients (McAlister et al., 2001).

Evidence for Additional Information Supporting Need for the Measure

Hunt SA, Abraham WT, Chin MH, Feldman AM, Francis GS, Ganiats TG, Jessup M, Konstam MA, Mancini DM, Michl K, Oates JA, Rahko PS, Silver MA, Stevenson LW, Yancy CW, American College of Cardiology Foundation, American Heart Association. 2009 focused update incorporated into the ACC/AHA 2005 guidelines for the diagnosis and management of heart failure in adults [trunc]. J Am Coll Cardiol. 2009 Apr 14;53(15):e1-e90. [810 references] PubMed

Jessup M, Brozena S. Heart failure. N Engl J Med. 2003 May 15;348(20):2007-18. PubMed

Jha AK, Orav EJ, Li Z, Epstein AM. The inverse relationship between mortality rates and performance in the Hospital Quality Alliance measures. Health Aff (Millwood). 2007 Jul-Aug;26(4):1104-10. PubMed

Lloyd-Jones D, Adams RJ, Brown TM, Carnethon M, Dai S, De Simone G, Ferguson TB, Ford E, Furie K,

Gillespie C, Go A, Greenlund K, Haase N, Hailpern S, Ho PM, Howard V, Kissela B, Kittner S, Lackland D, Lisabeth L, Marelli A, McDermott MM, Meigs J, Mozaffarian D, Mussolino M, Nichol G, Roger VL, Rosamond W, Sacco R, Sorlie P, Roger VL, Thom T, Wasserthiel-Smoller S, Wong ND, Wylie-Rosett J, American Heart Association Statistics Committee and Stroke Statistics, Writing Group Members. Heart disease and stroke statistics--2010 update: a report from the American Heart Association. Circulation. 2010 Feb 23;121(7):e46-e215. PubMed

McAlister FA, Lawson FM, Teo KK, Armstrong PW. A systematic review of randomized trials of disease management programs in heart failure. Am J Med. 2001 Apr 1;110(5):378-84. PubMed

National Heart, Lung, and Blood Institute. Tabulation of NHANES, 1971-1975, 1976-1980, 1988-1994, 1999-2002, 2003-2006, and extrapolation to the U.S. population, 2007 [unpublished].

Extent of Measure Testing

Assessment of Updated Models

The heart failure (HF) measure estimates hospital-specific 30-day all-cause risk-standardized mortality rates (RSMRs) using a hierarchical logistic regression model. Refer to Section 2 in the original measure documentation for a summary of the measure methodology and model risk-adjustment variables. Refer to prior methodology and technical reports for further details.

The Centers for Medicare & Medicaid Services (CMS) evaluated and validated the performance of the models, using July 2013 to June 2016 data for the 2017 reporting period. They also evaluated the stability of the risk-adjustment model over the three-year measurement period by examining the model variable frequencies, model coefficients, and the performance of the risk-adjustment model in each year.

CMS assessed logistic regression model performance in terms of discriminant ability for each year of data and for the three-year combined period. They computed two summary statistics to assess model performance: the predictive ability and the area under the receiver operating characteristic (ROC) curve (c-statistic). CMS also computed between-hospital variance for each year of data and for the three-year combined period. If there were no systematic differences between hospitals, the between-hospital variance would be zero.

The results of these analyses are presented in Section 4.4 of the original measure documentation.

HF Mortality 2017 Model Results

Frequency of HF Model Variables

CMS examined the change in the frequencies of clinical and demographic variables. Frequencies of model variables were stable over the measurement period. The largest changes in the frequencies (those greater than 2% absolute change) include increases in Renal failure (61.4% to 63.6%), Cardio-respiratory failure and shock (28.0% to 31.5%), and Trauma; other injuries (40.6% to 42.7%).

HF Model Parameters and Performance

Table 4.4.2 in the original measure documentation shows hierarchical logistic regression model variable coefficients by individual year and for the combined three-year dataset. Table 4.4.3 in the original measure documentation shows the risk-adjusted odds ratio (ORs) and 95% confidence intervals for the HF mortality model by individual year and for the combined three-year dataset. Overall, the variable effect sizes were relatively constant across years. In addition, model performance was stable over the three-year time period; the c-statistic decreased slightly from 0.69 to 0.68.

Refer to the original measure documentation for additional information.

Evidence for Extent of Measure Testing

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 condition-specific measures updates and specifications report: hospital-level 30-day risk-standardized mortality measures. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017 Mar. 98 p. [29 references]

State of Use of the Measure

State of Use

Current routine use

Current Use

not defined yet

Application of the Measure in its Current Use

Measurement Setting

Hospital Inpatient

Professionals Involved in Delivery of Health Services

not defined yet

Least Aggregated Level of Services Delivery Addressed

Single Health Care Delivery or Public Health Organizations

Statement of Acceptable Minimum Sample Size

Specified

Target Population Age

Age greater than or equal to 65 years

Target Population Gender

Either male or female

National Strategy for Quality Improvement in Health Care

National Quality Strategy Aim

Better Care

National Quality Strategy Priority

Making Care Safer

Institute of Medicine (IOM) National Health Care Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Safety

Data Collection for the Measure

Case Finding Period

Discharges July 1, 2013 through June 30, 2016

Denominator Sampling Frame

Patients associated with provider

Denominator (Index) Event or Characteristic

Clinical Condition

Institutionalization

Patient/Individual (Consumer) Characteristic

Denominator Time Window

not defined yet

Denominator Inclusions/Exclusions

Inclusions
An *index admission* is the hospitalization to which the mortality outcome is attributed and includes admissions for patients:

Having a principal discharge diagnosis of heart failure (HF)*
Enrolled in Medicare Fee-for-Service (FFS) Part A and Part B for the 12 months prior to the date of admission, and enrolled in Part A during the index admission

Aged 65 or over
Not transferred from another acute care facility

*International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) codes used to define the HF cohort for discharges on or after October 1, 2015:

I11.0 Hypertensive heart disease with heart failure
I13.0 Hypertensive heart and chronic kidney disease with heart failure and stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease
I13.2 Hypertensive heart and chronic kidney disease with heart failure and with stage 5 chronic kidney disease, or end stage renal disease
I50.1 Left ventricular failure
I50.20 Unspecified systolic (congestive) heart failure
I50.21 Acute systolic (congestive) heart failure
I50.22 Chronic systolic (congestive) heart failure
I50.23 Acute on chronic systolic (congestive) heart failure
I50.30 Unspecified diastolic (congestive) heart failure
I50.31 Acute diastolic (congestive) heart failure
I50.32 Chronic diastolic (congestive) heart failure
I50.33 Acute on chronic diastolic (congestive) heart failure
I50.40 Unspecified combined systolic (congestive) and diastolic (congestive) heart failure
I50.41 Acute combined systolic (congestive) and diastolic (congestive) heart failure
I50.42 Chronic combined systolic (congestive) and diastolic (congestive) heart failure
I50.43 Acute on chronic combined systolic (congestive) and diastolic (congestive) heart failure
I50.9 Heart failure, unspecified

Note: International Classification of Diseases, Ninth Revision (ICD-9) code lists for discharges prior to October 1, 2015 can be found in the *2016 Condition-specific Mortality Measures Updates and Specifications Report* .

Exclusions

Discharged alive on the day of admission or the following calendar day who were not transferred to another acute care facility
Inconsistent or unknown vital status or other unreliable demographic (age and gender) data
Enrolled in the Medicare hospice program any time in the 12 months prior to the index admission, including the first day of the index admission
Discharged against medical advice
With a procedure code for left ventricular assist device (LVAD) implantation or heart transplantation either during the index admission or in the 12 months prior to the index admission

For patients with more than one eligible admission for HF in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort. Additional admissions within that year are excluded.

Exclusions/Exceptions

not defined yet

Numerator Inclusions/Exclusions

Inclusions
The measure counts death from any cause within 30 days of the start of the index admission.

The risk-standardized mortality rate (RSMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted based on the hospital's performance with its observed case mix.

Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, this field is used to define the outcome.

See the *2017 Condition-specific Measures Updates and Specifications Report. Hospital-level 30-day Risk-standardized Mortality Measures* for more details.

Exclusions
Unspecified

Numerator Search Strategy

Institutionalization

Data Source

Administrative clinical data

Type of Health State

Death

Instruments Used and/or Associated with the Measure

None

Computation of the Measure

Measure Specifies Disaggregation

Does not apply to this measure

Scoring

Rate/Proportion

Interpretation of Score

Desired value is a lower score

Allowance for Patient or Population Factors

not defined yet

Description of Allowance for Patient or Population Factors

Risk-Adjustment Variables

In order to account for differences in case mix among hospitals, the measure adjusts for variables (for example, age, comorbid diseases, and indicators of patient frailty) that are clinically relevant and have relationships with the outcome. For each patient, risk-adjustment variables are obtained from inpatient, outpatient, and physician Medicare administrative claims data extending 12 months prior to, and including, the index admission.

The measure adjusts for case mix differences among hospitals based on the clinical status of the patient at the time of the index admission. Accordingly, only comorbidities that convey information about the patient at that time or in the 12 months prior, and not complications that arise during the course of the hospitalization, are included in the risk adjustment.

The measure does not adjust for socioeconomic status (SES) because the association between SES and

health outcomes can be due, in part, to differences in the quality of healthcare that groups of patients with varying SES receive. The intent is for the measure to adjust for patient demographic and clinical characteristics while illuminating important quality differences. As part of the National Quality Forum's (NQF's) endorsement process for this measure, the Centers for Medicare & Medicaid Services (CMS) completed analyses for the two-year Sociodemographic Trial Period. Although univariate analyses found that the patient-level observed (unadjusted) mortality rates are higher for dual-eligible patients (for patients living in lower Agency for Healthcare Research and Quality [AHRQ] SES Index census block groups) and African-American patients compared with all other patients, analyses in the context of a multivariable model demonstrated that the effect size of these variables was small, and that the c-statistics for the models are similar with and without the addition of these variables.

Refer to Appendix D of the original measure documentation for the list of comorbidity risk-adjustment variables and the list of complications that are excluded from risk adjustment if they occur only during the index admission.

Standard of Comparison

not defined yet

Identifying Information

Original Title

Hospital-level 30-day RSMR following HF.

Measure Collection Name

National Hospital Inpatient Quality Measures

Measure Set Name

Mortality Measures

Submitter

Centers for Medicare & Medicaid Services - Federal Government Agency [U.S.]

Developer

Centers for Medicare & Medicaid Services - Federal Government Agency [U.S.]

Yale-New Haven Health Services Corporation/Center for Outcomes Research and Evaluation under contract to Centers for Medicare & Medicaid Services - Academic Affiliated Research Institute

Funding Source(s)

Centers for Medicare & Medicaid Services (CMS)

Composition of the Group that Developed the Measure

This measure was primarily developed by a team of clinical and statistical experts from the Centers for Medicare & Medicaid Services, Mathematica Policy Research, Colorado Foundation for Medical Care, and Yale University. The following experts helped to develop the measure:

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Financial Disclosures/Other Potential Conflicts of Interest

None

Endorser

National Quality Forum - None

NQF Number

not defined yet

Date of Endorsement

2016 Feb 19

Core Quality Measures

Cardiology

Measure Initiative(s)

Hospital Compare

Hospital Inpatient Quality Reporting Program

Adaptation

This measure was not adapted from another source.

Date of Most Current Version in NQMC

2017 Mar

Measure Maintenance

Annual

Date of Next Anticipated Revision

2018 Apr

Measure Status

This is the current release of the measure.

This measure updates a previous version: Specifications manual for national hospital inpatient quality measures, version 5.0b. Centers for Medicare & Medicaid Services (CMS), The Joint Commission; Effective 2015 Oct 1. various p.

Measure Availability

Source available from the QualityNet Web site .

Check the QualityNet Web site regularly for the most recent version of the specifications manual and for the applicable dates of discharge.

Companion Documents

The following are available:

Hospital compare: a quality tool provided by Medicare. [internet]. Washington (DC): U.S. Department of Health and Human Services; [accessed 2017 Oct 3]. This is available from the Medicare Web site .

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 Medicare hospital quality chartbook. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017. Available from the Centers for Medicare & Medicaid Services (CMS) Web site .

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 condition-specific mortality measures updates and specifications report: supplemental ICD-10 code lists for use with claims for discharges on or after October 1, 2015. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017. Available from the QualityNet

Web site .

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Production

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